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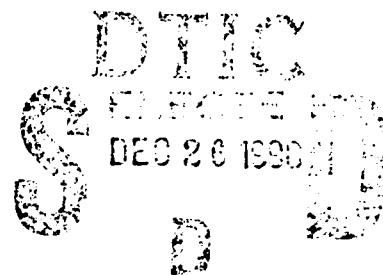
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AFIT/GLM/LSY/90S-54



ADAPTING THE LOGISTICS PLANNING  
AND REQUIREMENTS SIMPLIFICATION  
SYSTEM TO MEET AIR FORCE NEEDS

THESIS

Britton M. Smeal  
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AFIT/GLM/LSY/90S-54

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ADAPTING THE LOGISTICS PLANNING AND REQUIREMENTS

SIMPLIFICATION SYSTEM TO MEET AIR FORCE NEEDS

THESIS

Presented to the Faculty of the School of Systems  
and Logistics of the Air Force Institute of Technology

Air University

In Partial Fulfillment of the  
Requirements for the Degree of  
Master of Science in Logistics Management

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September 1990

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## Preface

The purpose of the study was to investigate an ILS expert system, LOGPARS, and develop a prototype module--the Strategy Advisor--to lay the groundwork for a complete modification of the program. The study revealed the processes, resources, and capabilities required for ALD to change and maintain LOGPARS and shortened the time and effort required for ALD to complete the LOGPARS modification. The prototype development effort demonstrated the application of the processes.

I received a great deal of help from other people during my research effort and thesis writing. I am greatly appreciative of the U.S. Army Material Readiness Support Agency's Mr. Jay Graver and Mr. Carlos Camacho for providing me with their technical expertise and computer resources. I thank Mr. Jim Roe, ALD/LSL, for his technical advice, without which the research would never have gotten off the ground. I also thank my thesis advisor, Dr. Norman Ware, and reader, Mr. Richard Andrews, for their patience and guidance. I cannot properly express my appreciation to my wife, Joyce, and two sons for their constant love and understanding. Finally, I must give thanks and praise to my Lord and God, without Whom I could accomplish nothing.

Britton M. Smeal

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Abstract

This study investigated the computer information needs of Integrated Logistics Support Managers in System Program Offices at Wright-Patterson AFB, OH, with the results being used to adapt the Army's expert system, The Logistics Planning and Requirements Simplification System (LOGPARS), for Air Force use. LOGPARS advises the manager on several important logistics tasks, including general strategy formulation, preparation of an Integrated Logistics Support Plan, a Statement of Work, a Contract Data Requirements List, and warranty clauses. The result of this study was the identification of the processes, capabilities, and resources required of the Acquisition Logistics Division (ALD) to successfully change and maintain LOGPARS. The prototype provided the Acquisition Logistics Division with the beginnings of a true knowledge-based system to make logistics planning and requirements determination simpler. Based on the success of this thesis effort, ALD/LSL plans to complete the LOGPARS modification project and make the Air Force version available to all acquisition logistics offices.

ADAPTING THE LOGISTICS PLANNING AND  
REQUIREMENTS SIMPLIFICATION SYSTEM  
TO MEET AIR FORCE NEEDS

I. Introduction

Overview

This chapter explores the need for applying a computer based knowledge system for simplifying acquisition integrated logistics support (ILS) planning and for modifying the Army's Logistics Planning and Requirements Simplification System (LOGPARS) to meet Air Force needs. Background information is presented, followed by a statement of the management problem and the specific research problem. The investigative questions are then stated and the scope of the research effort is defined. Next, the assumptions, approach and sequence of presentation of the study are discussed. Finally, the definition of terms and overview of the thesis are presented.

Background

The need for good computer tools is well documented. General Loh, former Commander of the Aeronautical Systems Division, commented that acquiring software is something the

Air Force does poorly and must improve (23). This situation exists despite Department of Defense (DoD) efforts to improve. The DoD been pursuing integrated, automated acquisition efforts since 1985, when the Deputy Secretary of Defense approved recommendations to improve the supportability of weapon system designs by computer automation (13:3). The Computer-aided Acquisition and Logistic Support (CALS) initiative was born in response to the need to reduce paperwork and "improve quality and productivity throughout the weapon system life cycle" (13:4).

The Aeronautical Systems Division (ASD) and the Acquisition Logistics Division (ALD) at Wright-Patterson AFB are seeking effective and reliable computer software tools to realize productivity gains, aid acquisition logistics managers and planners, and comply with the CALS initiatives (24). Recent developments in computer software programs, called knowledge-based systems, offer the potential to help managers produce high quality and consistent output while employing less man-hours of work.

Computer software development is a time consuming and expensive effort requiring a high level of expertise. Occasionally an opportunity arises where government owned software can be adapted internally to meet organizational needs, thus saving time and money while not requiring as

much high-level technical expertise as would be needed to develop new programs from scratch. The Army's ILS expert system, LOGPARS, is one such opportunity. This thesis explores the processes, resources, and capabilities required to successfully change LOGPARS, thereby helping fill the Air Force need for an integrated acquisition logistics support planning tool, and adapts the first module of that program, the Strategy Advisor.

Computer software has evolved over the years from requiring users to have a personal knowledge of programming to the point where "user friendly" programs can be run by people who have limited knowledge about programming. "Fourth generation" software allows for the application of knowledge based (expert) systems (22:3). Expert systems seek to capture the knowledge of the "expert" in a given area onto a computer based information system and then use that system to help managers solve problems. The Air Force can benefit greatly by applying expert systems to many situations where decision support systems are beneficial.

#### Statement of the Problem

The Computer-aided Acquisition Logistics Support (CALS) program was a Department of Defense (DoD) response to criticisms for acquisition planning deficiencies (10:1). The purpose of CALS is to achieve "integrated and automated

digital technical information for weapon system design, manufacture, and support" (13:3). Five years later, progress has been very slow as programs have been adopted piecemeal (31:26). The U.S. Air Force, Acquisition Logistics Division (ALD) identified a need for an integrated computer based ILS program to enhance the Computer Supported Network Analysis System (CSNAS) to comply with CALS initiatives and improve productivity and consistency in the planning process (8:1; 14). The cost to pay a contractor to develop such a program would be prohibitive in the current era of shrinking budgets and would be a duplication of effort because the U.S. Army has successfully developed and employed an expert system, LOGPARS.

Because the Army paid American Management Systems, Inc. to develop LOGPARS the government owns all rights to its use, any government agency can use the program without cost or copyright infringement problems. The Air Force would accrue several benefits by adapting LOGPARS to meet its acquisition logistics planning needs. The first benefit would be the time saved by not having to engage in the authorization and contracting effort. The second benefit would be the money saved by not paying a contractor's fee. Also, the user would have more direct input into the development of the program because ALD would be both the developer and the user. Finally, expert systems offer

several benefits, including quick and consistent decisions, a "captive" knowledge base, dispersed knowledge, and improved service levels (26:25). While this is by no means a complete discussion of the savings and benefits gained by the Air Force, the reader can grasp the significance of ALD adapting LOGPARS internally rather than hiring a contractor.

The Department of Defense encouraged the Air Force Acquisition Logistics Division (ALD) to participate in the LOGPARS development effort (14). ALD has directed the logistics support office to modify LOGPARS for Air Force use and designated Mr. Jim Roe, ALD/LSL, as the point of contact for the project. The researcher, through his interest in CALS and ILS, learned of this project and volunteered to participate in the modification effort. ALD/LSL then agreed to sponsor this thesis research. The researcher was assigned the task of modifying the Strategy Advisor module of LOGPARS while ALD pursued concurrent efforts to develop the Scheduling Advisor and ILSP Generator. The Army Materiel Readiness Support Activity, DoD point of contact for LOGPARS, agreed to assist the researcher in making the changes necessary to produce an Air Force version of the Strategy Advisor. The sponsor plans to use the prototype module as a starting point for the development of the Air Force version of LOGPARS (AFLOGPARS?).

### Specific Problem

An ILS expert system, LOGPARS, is available to fill the Air Force need for an integrated ILS planning tool. However, Air Force acquisition logisticians can not use LOGPARS because the program is based on Army jargon, requirements, and applications. The Army-unique text and requirements must be modified to reflect those of the Air Force. Because the LOGPARS program is complex, the process involved in making changes to the expert system portion of the program is unknown to ALD and must be identified.

### Investigative Questions

The specific problem can be solved by answering these basic questions:

1. What are the specific needs of the Air Force users of the software?
2. How do Army ILS requirements and needs differ from those of the Air Force?
3. What changes are necessary to LOGPARS to adapt it for Air Force use?
4. How can LOGPARS be changed and maintained and what resources are required for ALD to acquire this capability?

### Scope

This study is limited to examining how to adapt LOGPARS only. Adapting other software programs would likely follow

a similar process, but verifying this possibility is beyond the scope of this study.

This is a cross-sectional research effort, limited to studying a stated problem at a given point in time. This study is intended to solve a particular problem (adapting LOGPARS) at a particular time (now) at a particular place (Acquisition Logistics Division at Wright-Patterson AFB). Although the researcher contends that the prototype Strategy Advisor is usable by any Air Force acquisition organization, no attempt has been made to evaluate or validate the possible uses of the software outside the ILS environment at the program offices at Wright-Patterson AFB.

#### Assumptions

Important to the validity of this study is the assumption that LOGPARS adequately serves Army needs for ILS computerized planning and requirements determination. No attempt will be made to question the validity of the program or evaluate how well it functions. The underlying structure and programming language of LOGPARS is assumed to be accurate. The program only needs to be changed to meet peculiar Air Force requirements, output and input forms, and terminology.



### Approach

The thesis study was divided into four phases: (1) problem assessment, (2) LOGPARS review, (3) prototype development, and (4) research effort critique. The problem assessment phase familiarized the researcher with the needs of the ALD users and led to a better understanding of expert systems and the functions and features of the LOGPARS program. Chapter III, Literature Review, corresponds with this phase. Information was obtained through a literature review and personal interviews.

The LOGPARS review phase consisted of identifying specific changes required to adapt the program to meet Air Force needs. The review included terminology, forms, and requirements of regulations and directives that differed between the two services. Chapter IV of this thesis describes the researcher's efforts in the review phase.

The prototype development phase, Chapter V, consisted of making the changes to LOGPARS identified by the review phase. The goal of the prototype development phase was to modify the first module to assess the feasibility and practicality of modifying the entire LOGPARS program. The first module of the LOGPARS program, the Strategy Advisor, was chosen because of its significance to the overall program. All other modules and products of the program

depend on the Strategy Advisor for decision criteria and data.

The final phase, research critique, was an evaluation of the usefulness of the research effort to the sponsor. ALD/LSL critiqued the research effort according to how well the four objectives stated in Chapter VI were satisfied. The critique also provided feedback for further changes to the program and is described in Chapter VI.

#### Sequence of Presentation

Chapter II explains the methodology used by the researcher to solve the problem and find answers to the investigative questions.

Chapter III is a literature review consisting of information pertinent to understanding the problem this research addresses. Chapter IV describes the LOGPARS review conducted by the researcher to identify changes necessary to adapt LOGPARS. Chapter V explains how the author of this thesis actually modified LOGPARS to develop a prototype module. Chapter VI consists of the results of the prototype critique and Chapter VII summarizes the results of this thesis, including recommendations for further study.

#### Definition of Terms

Acquisition Logistics - "the process of systematically identifying and assessing logistics alternatives, analyzing

and resolving ILS deficiencies, and managing ILS throughout the acquisition process" (5:1-1).

Data - "something used as a basis for discussion, decision making, calculating, or measuring" (25:15).

Decision Support System - "an information system designed to aid managers in the decision making process" (25:15).

Expert systems - "computer programs that use human traits like logic to solve problems" (26:358).

Information - "processed data, or meaningful data. Information tells someone something that he or she did not previously know" (25:15).

Integrated Logistics Support (ILS) - "a disciplined, unified, and iterative approach to the management and technical activities necessary to integrate support considerations into system design...develop support requirements that are related consistently to readiness objectives, to design, and to each other...acquire the required support...provide the required support during the operational phase at minimum cost" (12:2-2).

Integrated Logistics Support Manager (ILSM) - for the purposes of this study an ILSM is anyone with responsibility for one or more logistics elements, managing any part of the acquisition logistics effort, and the Deputy Program Manager for Logistics.

Logistic Support Analysis (LSA) - "the selective application of scientific and engineering efforts undertaken during the acquisition process, as part of the systems engineering process, to assist in causing support considerations to influence design...defining support requirements...acquiring the required support...providing the required support during the operational phase at minimum cost" (12:2-2).

Management Information System (MIS) - "formal and informal systems that provide past, present, and projection information in a written or oral form relating to the firm's internal operations and its environment. It supports the managers and employees and key environmental elements by furnishing information in the proper time frame to assist in decision making" (25:17).

Project Management and Review Technique (PERT) - "a network technique used for project planning and scheduling, which consists of probabilistic activity times" (32:784).

### Summary

The focus of this research study is an effort to adapt the Army's integrated logistics support expert system, LOGPARS, to meet the needs of the Air Force. By adapting the computer software internally the Air Force saves money.

eliminates duplication of effort among the different services, and complies with DoD CALS initiatives.

## II. Methodology

### Overview

This chapter describes how the researcher discovered answers to the investigative questions posed in Chapter I. The research procedure is outlined and the methodology is stated and justified.

### Research Methodology and Justification

The following description summarizes the methodology used to thoroughly investigate the problem and provide accurate answers to the investigative questions upon which useful conclusions can be drawn. The procedure follows the classical three stage process (15:58).

Stage I. Exploration. The purpose of the literature review was to gather background information on the current state of knowledge on the subject. This study identified research completed in areas relating to the computer software needs of the Integrated Logistics Support Managers and explained how an expert system can satisfy some of those needs. Information required by the thesis was collected by interviewing ILSMs and other acquisition personnel, and experience gained during the actual process of adapting LOGPARS, and scanning published sources. Published sources such as theses, books, and magazine articles provided valuable insight into areas such as the general information

needs of the ILSMs, expert systems, LOGPARS, and military ILS requirements. The information discovered in this stage comprises the bulk of Chapter III.

Stage II Data Collection. Data Collection began with the identification of specific changes required to adapt LOGPARS to meet the needs of Air Force ILSMs. The information came from literature, interviews, common sense, and experience by running LOGPARS and examining the menus, "help" screens, and reports of the Strategy Advisor. Notes were taken during the process and an outline was developed by the researcher and described briefly as four phases in Chapter I. The information discovered during this stage is presented in Chapter IV.

Stage III Analysis and Interpretation of Results. Stage III describes the investigation of the change process and the development of the prototype Strategy Advisor. Before the Strategy Advisor could be changed methods and processes had to be identified that would enable the researcher to properly change the program. The exact processes were identified by visiting MRSA in Lexington, Kentucky, and working with knowledge system experts to develop the prototype. The prototype was critiqued by the research sponsor to determine the acceptability of the module as a baseline for the complete modification and

validate the usefulness of the research effort. The results of the critique are presented in Chapter VI.

The value of the module as a prototype lies not in whether the module is a fully accurate and "perfect" program, but rather in the process identified to change LOGPARS and the information learned concerning the resources and capabilities ALD will need to continue with the LOGPARS modification. Acceptance of the Strategy Advisor prototype would shorten the time span required to complete the LOGPARS prototype development and provide some insight as to the time and effort required to develop a fully operational "AFLOGPARS".

The critique process was not determined by the researcher but by the sponsor because the sponsor is the best judge of how well the product meets their needs. The process was simple: ALD/LSL evaluated how well the research effort met their objectives and executed the prototype module, examining the screens, menus, and output. A subjective opinion was formed about the overall usefulness of the research and prototype. The critique process is described in greater detail in Chapter VI.

### Validity

All scientific research must be concerned about validity, both internal and external. Internal validity



depends on: 1) content validity, or complete coverage of the area, 2) criterion validity, or ensuring a lack of bias and accuracy of the measurement, and 3) construct validity, or the predictive value (15:95-97). External validity is applying the study to populations outside the one(s) studied and measuring how consistent the conclusions are. External validity is not a concern of this study but a recommendation is included in Chapter VII for further study. This researcher believes the results of this study will enable the sponsor to complete the Air Force LOGPARS modification but further study should be conducted to verify this opinion.

Bias was avoided, in part, by the critique of the research effort and prototype Strategy Advisor by ALD/LSL rather than by the researcher. Another factor in avoiding bias was by the guidance provided by the "stakeholders" of the program, the sponsor and the ILSMs. During the entire research effort the researcher sought and used the advice and guidance of both the sponsor and ILSMs.

### Summary

This chapter describes how the researcher plans to solve the problem stated in Chapter I. The methodology consists of three stages: 1) exploration, 2) data collection, and 3) analysis and interpretation of results.

The information generated by the analysis will serve as the basis for the conclusions stated in Chapter VII.

### III. Literature Review

#### Overview

This chapter describes the information discovered by the researcher during the first stage of the research process - exploration. The exploration includes both published sources and personal interviews. The purpose of the literature review is to investigate the area of study and present relevant information on that subject. The organization of literature discussion is presented followed by a discussion of the literature review.

#### Organization of the Literature Discussion

The information is organized into three sections: 1) logistics support information needs of the Integrated Logistics Support Managers, 2) knowledge-based, or expert systems, and 3) the Logistics Planning and Requirements Simplification System (LOGPARS).

#### Computer Information Needs of the ILSMs

The needs of the ILSMs are reflected in the underlying impetus for the Computer-aided Acquisition Logistics Support (CALS) program. CalS was conceived as a response to the Acquisition Improvement Program, which addressed criticisms concerning a perceived lack of ILS planning (11:1).

The CALS brochure defines CALS as follows:

CALS is a DoD and industry strategy for the transition from paper-intensive acquisition and logistics processes to a highly automated and integrated mode of operation for the weapon system of the 1990s. (13:2)

The objectives of CALS is to reduce lead time and cost while improving quality of weapons procurement that will lead to higher levels of operational readiness and industrial competitiveness (13:6,7).

The significance of CALS is that ILSOs must develop and use automated and integrated planning and analysis tools to improve the reliability, maintainability, and supportability of weapon systems. While many programs exist for specific tasks within ILS, no integrated tools exists to tie all the pieces of the acquisition logistics puzzle together:

The major shortfall of existing procedures is the lack of standardization, automation, and consolidation of front-end logistics planning. Current management tools are scattered. Inter-relationships between various automated systems and manual techniques do not exist. These deficiencies impose difficult, time consuming, and labor intensive management... (10:2)

The ILSMs face tremendous challenges in applying computers to satisfy their unique needs concerning project management and logistics planning. The researcher conducted personal and telephone interviews with twelve ILSMs to gain a better understanding of their needs. The purpose of the interviews was not to build a statistically significant

study but rather to enable the researcher to understand the needs and beliefs of the ILSMs.

The interviews revealed several areas where ILSMs believed they could benefit by applying a decision support system to solving ILS problems and also revealed some of their concerns about using computer systems in general. The interviews were directed toward determining how satisfied the ILSMs were with present software support tools and identifying areas where they believed daily ILS duties could benefit from more or better automation.

The ILSMs interviewed indicated that they were not satisfied with computer programs they presently had available for ILS planning (see Appendix A). This finding may not be surprising, but does indicate the need for better computer programs. The reasons for their dissatisfaction seemed to be: (1) an absence of standardized programs, (2) existing programs were too complicated, and (3) a lack of knowledge of existing computer programs available for a given task that (1; 2; 17; 34; 28).

ILSMs interviewed believed that some type of computer program could be developed to aid in planning or execution of the following ILS activities: (1) generic strategy formulation, (2) scheduling/milestones, (3) preparation of Integrated Logistics Support Plans (ILSP), Statements Of Work (SOW), and Contract Data Requirements Lists (CDRL), and

(4) warranty clauses, (5) determining spare parts and provisioning requirements, (6) life cycle costing estimates, (7) managing technical orders (see Appendix A).

Some concerns addressed by ILSMs deserve further discussion in this thesis. The first is the need for standardization of computer programs. For example, System Program Offices (SPOs) use a variety of milestone schedule tools (Scheduling Survey), with the most popular being the Computer Supported Network Analysis System (CSNAS) (7; 16; 30). Popular commercial programs include Timeline, Super Project, Artemis, Open Plan, MacSchedule, QuickPlan, and Harvard PERT (see Appendix B). The number of scheduling programs used is almost as numerous as the number of acquisition programs! Occasionally, program offices have contracted for development of scheduling software and hardware services, believing that neither CSNAS nor commercially available programs would satisfy their needs (2). The sheer number of choices complicates the decision process of choosing a scheduling program and limits the sharing of knowledge among program offices.

Another concern of ILSMs regards the perceived complexity of software programs. Numerous complaints about CSNAS not being "user friendly" have limited its usefulness (28). They expressed the opinion that the acceptance of a

program depends on its relative ease of use, or degree of "user friendliness" (28; 34).

The final area of concern is a perceived lack of computer applications to certain tasks accomplished by ILSOs. While ILSMs generally knew of several scheduling tools, they claimed little or no knowledge of programs that could help them prepare an ILSP, SOW, or CDRL. Some ILSMs employed spreadsheets such as LOTUS 1,2,3 or QUATTRO to store, organize, and retrieve data used in these documents (17; 28). This lack of familiarity with existing programs is startling because some tools do exist for these tasks and are available for use through ALD/LSL. ILSMs expressed the belief that no PC software programs were available to help determine provisioning, spare parts, support equipment, or Technical Order requirements (see Appendix A).

The responses by the ILSMs indicate that LOGPARS could meet identified needs in several areas, specifically strategy advisement, scheduling, warranty advisement, and preparing ILSPs, SOWs, and CDRLs.

#### Expert Systems

Expert systems are computer programs that apply human logic and reasoning to solve problems (26:358). Generally speaking, expert systems are decision support systems that attempt to capture the knowledge and decision rules of

"experts" into a program so that other people may benefit from the dissemination of that knowledge. Coupled with Fourth Generation computing (user friendly software and easy-to-use hardware), the application of expert systems to the office environment has become a reality (22:viii).

Efraim Turban explains in more detail what an expert system (ES) is:

ES is a computer program that includes a knowledge base containing an expert's knowledge for a particular problem domain and a reasoning mechanism for propagating inferences over the knowledge base. (33:367)

Simply put, an expert system solves problems that ordinarily require human intelligence (4:3).

ES Contrasted to DSS. ES can be thought of as an "intelligent" decision support system, but is not a true DSS. A DSS supports human decision making and is broad based, flexible, and adaptive (33:367) while ES is a closed system that acts as an advisor or actually replaces human decision making.

Benefits of ES. Expert systems are designed to preserve the knowledge of an expert and disseminate that knowledge. The expert's knowledge is no longer limited to one person's faculties and energies. This knowledge also represents information stored in an active form. The knowledge can be used at any time, not passively stored inside a person's brain where it must be recalled and



applied by that one person. Another important benefit involves experience and training. The novice can incorporate the stored knowledge of experts to aid his own decision making. Finally, ES can create a mechanism for retaining and applying knowledge that is not subject to human feelings, health, or other limitations (26:361).

John Chandler lists eight benefits of ES consistent with those expressed by Newquist above:

- 1) improved decision making,
- 2) more consistent decision making,
- 3) reduced design or decision making time,
- 4) improved training,
- 5) operational cost savings,
- 6) better use of experts' time,
- 7) improved products or service levels,
- 8) rare, or dispersed knowledge is captured (4:25).

Unfortunately for the manager, expert systems are only beginning to tackle the tough jobs of planning and control. Decision support programs, some of which are knowledge based, have been introduced in recent years in the area of project management. Some very good (and very expensive) software is available to the manager with the time and expertise (and budget) to properly choose a program (21:iv). Fortunately for Air Force ILSMs, the Army has spent the money and time to develop an expert system for ILS that only requires modification to be usable by the Air Force.

### Logistics Planning and Requirements Simplification System

LOGPARS is an Integrated Logistics Support (ILS) expert system developed under contract by the Army "... to provide logistic analyses, evaluations and other technical and management services in support of the (Army Materiel Command) materiel readiness mission during all phases of the life cycle management" (9:2). The need for LOGPARS is based on several factors, including a high turnover rate among ILS managers, a large volume of policy documents, a tremendous amount of ILS knowledge required to perform ILS duties, and a shortage of properly trained ILS managers (9:5). LOGPARS provides the user with several important, time-saving features.

LOGPARS Modules. The Strategy Advisor produces the foundation for acquisition strategy and ILS strategy. This option, or module, must be completed first because the results generated here are used throughout the entire program.

The Schedule Advisor creates system life cycle milestones. Gantt charts can be produced from the results of this module. Several automated features assist in life cycle ILS program management and must be updated as the program progresses through the life cycle phases.

The ILSP Generator helps the manager create the baseline ILSP. This module prompts the user for critical

information needed to plan and execute a comprehensive ILSP. The plan that results from this module is formatted and printed by a word processing program.

The ILS SOW Advisor creates the baseline SOW for programs entering the Demonstration/Validation or Full Scale Development phases of the program life cycle. The program has options for contractor or organic logistic support.

A CDRL Generator creates a working CDRL using Data Item Descriptions (DIDs) imported into the LOGPARS program, or a general purpose CDRL can be generated without DIDs. The CDRL can be printed with or without the DD Form 1423.

The Warranty Advisor module identifies legal and regulatory warranty requirements and recommends the best type of coverage for the program. A baseline warranty clause can be created and transferred to a word processor (11:3).

Using LOGPARS. LOGPARS can be installed on an IBM-type PC hard disk drive with at least four megabytes of memory and 640 kilobytes of RAM. The program consists of several modules, some of which must be run before others. The first module that must be run is the Strategy Advisor.

The Strategy Advisor produces the basic acquisition and Integrated Logistics Support strategy that drives all ILS and LSA considerations. Specific information required by the advisor include the acquisition type, program phases,

and major ILS and LSA products required. The user reviews ILS recommendations generated by the advisor for specific LSA elements and reconciles input with the knowledge system. An example would be the LSA tasks to be completed and who will complete those tasks (government or contractor). Once this module is completed, the user can generate milestone schedules complete with LOGPARS recommendations. Schedules can be updated and changed as needed and Gantt charts produced.

After the strategy is identified and schedules set several ILS products can be generated, including an ILS Statement Of Work, Integrated Logistics Support Plan, Contract Data Requirements List (CDRL), and warranty clauses. These products save users valuable time and can easily be exported to a word processing program for printing.

LOGPARS Benefits. The Army states that LOGPARS provides many important benefits to its users, including higher quality products by standardizing the ILSP process and facilitating feedback and refinement of products, productivity improvement with a multiplicative effect, and implements computer aided logistics system plans for the DoD (9:23). Any one of these benefits would validate LOGPARS' usefulness.

### Summary

This chapter described the information uncovered by the researcher in the exploration stage of the research process. The information is organized into three segments: 1) information needs of the ILSMs, 2) knowledge based or expert systems, and 3) the Logistics Planning and Requirements Simplification System.

#### IV. Strategy Advisor Review

##### Overview

This chapter explains the process by which the researcher identified changes necessary to adapt the LOGPARS Strategy Advisor for Air Force use. The chapter is organized according to the three steps used to accomplish the review: 1) Strategy Advisor review, which involved actually running the program to examine the screens and menus and identifying unacceptable verbiage and other information), 2) identify Army and Air Force "equivalents," for example, matching a given Army regulation with the Air Force equivalent, and 3) thorough review and documentation, which explored all the program options and documented changes for the actual modification. This last step immediately preceded the process of changing the program, which is described in Chapter V.

##### Introduction

The introduction to LOGPARS began with a simulation of an acquisition project to review the entire program. Captain John Gadsby (USAF Reserve), an ILSM with over eight years experience in acquisition logistics with the USAF and General Electric, assisted in this review. The researcher and Captain Gadsby simulated the acquisition strategy and ILS parameters of an actual project, the Joint Primary

Aircraft Trainer System (JPATS), to review all the LOGPARS modules and "walk through" the program. The purpose of the first "pass" through the program was two-fold: (1) demonstrate LOGPARS to Captain Gadsby and explore the program's features and elicit his suggestions for changes, and (2) get Captain Gadsby's feedback on how well he believes the expert system fits Air Force needs as an integrated logistics planning tool.

Captain Gadsby expressed the opinion that LOGPARS was an impressive and useful ILS tool and that an experienced logistics manager, being knowledgeable of acquisition jargon, could apply LOGPARS in its present state to Air Force programs (17). An experienced ILSM could identify specific Air Force regulations and directives that might differ from any Army requirements built into LOGPARS. However, the benefit of an expert system is that a novice can use the program to solve problems and gain sound advice for decision making. Captain Gadsby recommended spelling out more acronyms and addressing several notable problems to allow a less experienced ILSM to use LOGPARS. Otherwise, Captain Gadsby believes that an Air Force version of LOGPARS would be very useful.

The discrepancies mentioned by Captain Gadsby are differences between the Army and Air Force concepts of maintenance and the theaters of operation. A minor problem

was LOGPARS' twelve ILS elements versus the Air Force's ten. These problems are discussed below.

#### Strategy Advisor Review

The first step of the review process was to run the program and examine the screens, menus, and "helps" for obvious differences between Army and Air Force terminology and concepts. The first problem the researcher encountered regarded theaters where the weapon system would be deployed. LOGPARS prompted the user to "Identify the theaters to which the item will be fielded (at least one)." Several specific military commands and theaters of operation were listed which did not correspond to Air Force terminology. The solution was to simply identify the Air Force counterparts to the Army terms. However, one Army command, FORSCOM, has no Air Force counterpart. Deleting FORSCOM required changes to the programming logic; the effect of this change is discussed in Chapter V.

A second problem concerned the maintenance concept. The Army employs a flexible maintenance concept containing various levels, or echelons, involving three or more echelons. LOGPARS provided two responses for the prompt "Identify the type of maintenance concept which will be used..." The possible responses were, "Standard Army Maintenance Concept," and "Army Aviation Maintenance



Concept." The next prompt stated "Select the candidate levels of maintenance for the end item" and listed four choices; "unit," "direct support (DS)," "general support (GS)," and "depot." The current Air Force maintenance concept has three levels, which are organizational, intermediate, and depot. This discrepancy was the second change effecting the programming logic of LOGPARS.

A second run of the Strategy Advisor included printing out all reports of the Strategy Advisor and identifying terminology to change. The major report of the Strategy Advisor was a summary of recommendations generated by the expert system concerning general strategy and specific ILS elements. The ILS elements presented the researcher with another major obstacle--LOGPARS was based on twelve ILS elements but the Air Force uses the ten identified by DoD Directives (12:Enclosure 2-1; 6:Attachment 3). Because all the Air Force elements are represented in the twelve LOGPARS elements and no reference was made to "The ten major ILS elements" the format of the report was not changed. Reducing the elements to ten would have involved rewriting most of the LOGPARS.TXT file and seriously impact the logic of the expert system.

A minor difference between LOGPARS terminology and that of the Air Force is the first ILS Element--Design Influence, which is referred to as Design Interface by the Air Force

(6:7). The researcher identified other differences in the results report that were simply differences in terminology or regulation references. For example, references to "Army inventory" and "Army materiel" were fairly common, as were several regulations, such as "AR 70-1".

Finally, a third run explored "help" menus and the possible choices listed by LOGPARS' prompts. This was simply a check to "cover all the bases." After all differences were identified, the reconciliations for those differences were investigated in the second stage of the review process, identifying "equivalents."

#### Identifying Army and Air Force "Equivalents"

The second step in the review process was to identify Army and Air Force "equivalents." The intent of this was simply to match Air Force terminology and regulations to the references in LOGPARS which are Army terms and regulations. For example, LOGPARS contained several passages referring the user to "AR 70-10, Test and Evaluation During Development and Acquisition of Materiel." The researcher's task was to find an equivalent Air Force regulation addressing test and evaluation during the acquisition process. See Appendix D for a complete list of Army regulations and terminology and their Air Force equivalents that required changing in the Strategy Advisor.

The second step of the review process tied in the LOGPARS review to the literature review. Most of the information was readily available in published sources, while some was discovered simply by asking an ILSM, "What Air Force regulation do you use for guidance on tests and evaluations?" While this explanation of the process appears to be very simple, some of the information was not easily found. Once equivalents were identified, the third step of the review process, a thorough review and documentation, checked the Strategy Advisor in detail to identify all necessary changes to the module.

#### Thorough Review and Documentation

After the Strategy Advisor was screened to identify necessary changes, and specific verbiage and references found for those changes, the process was repeated in detail as a "double check" and to document all necessary changes. This last step in the review process required detailed documentation of specific changes within the program. The review was detailed by necessity because all changes had to be identified before involving the Army's Materiel Readiness Support Activity (MRSA) in the complex process of changing LOGPARS. All changes were documented by identifying the specific screen, menu, or report, listing the unacceptable items and the exact change (see Appendix D for a complete

list of changes). After the list was complete the researcher contacted MRSA to arrange for the ILS program office to change the Strategy Advisor according to Air Force needs.

#### Summary

This chapter explained the process the researcher used to identify changes necessary to adapt the Strategy Advisor for Air Force use. The review process included three steps: 1) Strategy Advisor review, 2) identify Army and Air Force equivalents, and 3) thorough review and documentation.

## V. Prototype Development

### Overview

This chapter describes the process of changing the LOGPARS Strategy Advisor into a prototype module for the sponsor, ALD/LSL. The researcher spent two days at the Lexington Blue Grass Army Depot working with the LOGPARS experts at MRSA to develop the Strategy Advisor prototype. The researcher identified necessary changes and the MRSA experts explained the best methods to make those changes. They invested the time to teach the researcher how to use the specific computer hardware and demonstrated the change process and LOGPARS Maintenance Program by making the two most complex changes. The researcher then completed the prototype development with the assistance of MRSA experts.

### The U.S. Army Materiel Readiness Support Activity

The mission of the U.S. Army Materiel Readiness Support Activity (MRSA) at Lexington, Kentucky, is to provide logistic analyses, technical and management services, and other ILS support (8:1). The EI branch manages the LOGPARS program and serves as the point of contact for DoD agencies interested in learning about LOGPARS applications. MRSA has developed a unique system to maintain the integrity of LOGPARS by integrating two software programs developed by MRSA personnel (referred to as the LOGPARS Maintenance

Program) with other programs that are commercially available (20). MRSA refers to this system as the LOGPARS Maintenance System.

#### The LOGPARS Maintenance System

The LOGPARS Maintenance System is composed of a commercial text editor--QEDIT, Norton Utilities, a prologue compiler--ARITY PROLOGUE, the LOGPARS Maintenance Program, and DAG--a utility program developed in-house by MRSA. The entire system runs on the MS-DOS operating system and a 286 or 386 PC with at least 80 megabytes of hard memory and 2 megabytes of RAM (20). The programs are "user-friendly" requiring no direct programming knowledge to run the system. The maintenance program and the PROLOGUE compiler represent the heart of the system. The role that each program plays in the system is described in the discussion that follows.

#### Changing the Strategy Advisor

The process for changing the Strategy Advisor consisted of four stages: (1) identify the location of the change within the program, make the change using a text editor, and trace the change through the program logic using the utility DAG if the programming logic may require changes, (2) rebuild the LOGPARS files with the LOGPARS Maintenance Program, (3) compile LOGPARS using a PROLOGUE compiler if

the change affected the logic of the expert system, and (4) test the new program to ensure it works correctly (3).

Finding Text Locations and Making Changes. Three methods were used to locate given data in the Strategy Advisor. The first method involved a "search and replace" or "find" routine to locate a given word or phrase. The LOGPARS maintenance system used Norton Utilities and QEDIT for this purpose. Norton Utilities revealed the line number within the program file containing the given text and a "go to" routine physically placed the cursor at that line number. Another option involved using the text editor QEDIT to "find" the text. QEDIT then made the necessary changes to the text. An example of this type of change was any single occurrence, such as changing the ILS element "Design Influence" to "Design Interface" within the LOGPARS.TXT file. The same approach was used to change text occurring several times. The "search and replace" routine of the text editor found the location of the item and made the change. For example, because references to "AR 70-1" were common the global change option of the "search and replace" routine of QEDIT found each location of "AR 70-1" and replaced it with "AFR 800-2."

A second method employed a similar approach, except DAG was then used to identify the corresponding data elements and files. All locations in the LOGPARS program along with

related data files were listed, revealing more changes necessary to maintain continuity throughout the program. Continuity refers to identifying and making changes to all data elements and files that are related to each other and affected by a previous change. For example, when one possible answer to the prompt instructing the user to identify the theaters of operation was deleted, the logic of the program and the knowledge base were changed because each option was a data element referring LOGPARS to decision rules. Norton Utilities linked the data element "theaters" to the data file "fielding\_theaters." This file contained the prompt and options. One option "FORSCOM" was deleted and others were changed, affecting the structure of the knowledge base. DAG was used to identify other data files relating to "fielding\_theaters" and they were changed to reflect the deletion of "FORSCOM."

A third method was simply to call up a file, such as LOGPARS.TXT (text files used to build reports or recommendations) or LOGPARS.HELP (contains all HELP files), and manually search every line of the file. This method was used when new text was added and for extensive changes to existing paragraphs or sentences. For example, a paragraph was added to the LOGPARS.TXT file (containing ILS element recommendations) reflecting the Air Force requirement for a Maintenance Allocation Plan. This technique also served as



a trouble-shooting technique when a given paragraph was checked for readability. The technique was used sparingly to avoid making fragmented changes that may cause problems for other LOGPARS modules.

Rebuilding LOGPARS Files. All text changes required the LOGPARS files to be rebuilt by the LOGPARS Maintenance Program. Rebuilding the files refers to translating the PROLOGUE program language into assembler language for faster and more efficient LOGPARS program execution (3). The program searches and fetches files more quickly to minimize user waiting time. The LOGPARS files were rebuilt simply by calling up the LOGPARS Maintenance Program and selecting the rebuild option from the main menu. The software did the work in three to five minutes on a Zenith 386 PC.

Compiling LOGPARS. Any changes that affected the internal logic of the program, or structure, required that LOGPARS be compiled by the PROLOGUE compiler. The logic of the program refers to the relationships among data files or the "rules" of the knowledge base (3). The relationships built into the knowledge base separate expert systems from other computer programs. The greater complexity of those relationships present greater challenges to the programmer and maintainer. The logic of an expert system must be maintained throughout the program or the program will not execute properly. The LOGPARS Maintenance Program was

executed to call up the ARITY PROLOGUE compiler to re-format the entire program and "map" data elements and relationships and identify fatal errors for the operator to correct before testing the new program.

Two Strategy Advisor changes required compiling: (1) the prompt offering the choice between two maintenance concepts, and (2) the options to the prompt directing the user to identify theaters of operation of the weapon system. Any changes to the STRA.DAT file (contains all prompts and options LOGPARS asks within the Strategy Advisor) required the operator to compile LOGPARS.

Testing the New Program. The new program was tested to ensure the required changes were made correctly. A test directory was created to load and execute the new program using another LOGPARS Maintenance Program option--test. LOGPARS was executed and screens, helps, menus, and recommendations checked for accuracy. After testing, the Air Force version of the Strategy Advisor was complete.

### Summary

The LOGPARS Strategy Advisor prototype was developed using a four step process: (1) identify the location of the text and making the change, (2) rebuild the LOGPARS files, (3) compile LOGPARS if the logic of the program was changed, and (4) test the new program. This process can be employed

by the sponsor to make changes to any of the LOGPARS modules if the required software, hardware, and technical expertise can be obtained.

The discussion presented in this chapter only hints at the real complexity of changing an expert system. The resources and expertise of MRSA were required to develop the Strategy Advisor. The LOGPARS Maintenance System, consisting of several programming tools, simplified the change and maintenance process, making the complexities transparent to the operator.

## VI. Research Critique and ALD Comments

### Overview

This chapter describes the sponsor's qualitative critique of how well the objectives of the research effort were met. The sponsor, ALD/LSL, critiqued the research effort according to the objectives developed specifically for this study.

### Objectives

The sponsor and researcher jointly established four objectives of the research and agreed that the sponsor would subjectively measure the effectiveness of the research in satisfying each objective within the overall research effort. The objectives were: (1) nurture a cooperative relationship between MRSA and ALD, (2) identify the resources, capabilities, and processes required to make changes to LOGPARS, (3) identify and make specific changes as necessary to the Strategy Advisor, and (4) develop a prototype Air Force Strategy Advisor.

The first two objectives were considered to be satisfied if the following question could be answered in the affirmative: "Did the research identify the required change process and did MRSA agree to share their expertise with ALD in order for LSL to develop its own capability to change and maintain LOGPARS?" The last two objectives were considered

to be satisfied if the following question could be answered in the affirmative: "Is the prototype useful to ALD in laying the foundation for a LOGPARS modification?"

#### Develop a Cooperative Relationship

The original intent of the research was to identify specific changes to adapt the Strategy Advisor for Air Force use and develop a usable prototype. The prototype would be evaluated by a "panel of experts" to determine its usefulness (29). However, these objectives assumed that ALD/LSL possessed the resources and expertise required to successfully make changes to the expert system. The assumption proved false. Special expertise and computer software was required which MRSA controlled (19). The objectives of the research were changed to reflect the reality that a process was needed to change LOGPARS, requiring the support and cooperation of MRSA. The researcher arranged to visit MRSA, which volunteered its facilities and expertise to help solve the problem and identified the process required to change LOGPARS and develop a prototype Strategy Advisor.

The importance of developing a cooperative relationship cannot be overstated, because the Air Force was dependant on MRSA for support. ALD possessed no inherent capability to change and maintain LOGPARS. Although MRSA volunteered to

help adapt LOGPARS it did not offer ALD its maintenance system until after the researcher's visit:

The working relationship between MRSA and our organization has greatly improved as a result of your efforts. Your visit to (MRSA) proved to be vital in securing MRSA's support to provide us with the capability to change and maintain our own inputs to LOGPARS... (Appendix H)

Although not originally an objective, and certainly not typically a research objective, the key to an Air Force version of LOGPARS is dependant on ALD developing its own capability to change and maintain the program. The research satisfied this objective (Appendix H).

#### Identify Resources, Capabilities, and Processes

Mr. Jay Graver, LOGPARS Program Manager, identified the resources, capabilities, and expertise ALD would need to change and maintain LOGPARS (20). This information is recorded in Chapter V of this thesis. This objective was completely satisfied by the research effort (Appendix H).

ALD/LSL stated:

Perhaps the most vital and enduring aspect of your research is the knowledge gained regarding the resources, capabilities, and processes required to successfully change LOGPARS. (Appendix H)

#### Identify Changes

The changes required to adapt the Strategy Advisor are detailed in Appendix C: Change List, and Appendix D:

Equivalents. These changes were identified using the steps recorded in Chapter IV of this thesis. The processes of identifying changes and making those changes were reviewed by the sponsor by critiquing the prototype Strategy Advisor. ALD concluded that this objective was satisfied (Appendix H).

#### Develop the Prototype

The Air Force prototype Strategy Advisor is the culmination of the research. As is sometimes the case, the actual achievement of the final goal--a working prototype--proved anti-climactic. By the end of the research effort it became clear to both the researcher and the sponsor that the real value of the research was in the relationships, processes, resource requirements, and knowledge gained through the study and not so much in value of the prototype. The critique stated that the prototype was "useful" and it "serves our purposes for a prototype" (Appendix H). The last objective was considered to have been satisfied.

#### Conclusions

The sponsor concluded that the research effort met its objectives and expectations: "We believe that all four of our research expectations were met in a satisfactory manner" (Appendix H). Based on the critique by ALD/LSL one must conclude that the objectives were satisfied and the research

effort was successful and instrumental in achieving the goal of helping ALD/LSL modify LOGPARS.



## VII. Conclusions and Recommendations

### Overview

This chapter states the conclusions and recommendations of the researcher. A brief summary of the research effort is presented, followed by a discussion of conclusions and recommendations for further research.

### Research Summary

The purpose of the thesis research was to investigate the adaptation of the U.S. Army's ILS expert system, LOGPARS, for Air Force use and develop a prototype Strategy Advisor to lay the foundation for ALD/LSL to modify the entire program. The researcher examined the needs for an integrated, automated ILS tool as directed by the CALS initiative and identified LOGPARS as a means of complying with that initiative. A process for developing a prototype module was investigated and the organic resources and capabilities for making changes and maintaining LOGPARS by ALD/LSL were identified. A prototype Air Force Strategy Advisor was developed by the researcher with technical assistance provided by the U.S. Army Materiel Readiness Support Activity (MRSA) at Lexington, Kentucky, and delivered to ALD/LSL for review. The research effort was critiqued by ALD/LSL for effectiveness in satisfying the research objectives.

## Conclusions

This thesis demonstrated the feasibility of adapting software developed by the U.S. government for use by other various agencies within the government by answering the four investigative questions posed in Chapter I: (1) What are the specific needs of the Air Force users of the software, (2) How do Army ILS requirements and needs differ from those of the Air Force, (3) What changes are necessary to LOGPARS to adapt it for Air Force use, and (4) How can LOGPARS be changed and maintained and what resources are required for ALD to acquire this capability?

Investigative Question #1. The needs of the Air Force users were addressed by: (1) examining the underlying assumptions established by the CALS initiative, (2) interviewing ILSMs to gain an understanding of their needs, and (3) investigating the conclusions of the Scheduling Initiative Survey. The research revealed the need for an integrated ILS expert system and that the Army had already developed such a tool, LOGPARS. Chapter III presents the information addressing the first investigative question.

Investigative Question #2. The research revealed that the two services have similar ILS requirements based on DoD directives and established military standards. The LOGPARS program only needed modification to reflect Air Force

terminology and service-unique requirements. The information for answering this question was gathered from published sources, such as military regulations, and personal interviews with ILSMs, and is presented in Chapters III and IV.

Investigative Question #3. The changes required to the software were evident by comparing the information gathered from investigative question #2 to that contained in the actual LOGPARS program. Chapter IV describes the review process undertaken to identify changes required develop an Air Force Strategy Advisor module.

Investigative Question #4. Interviews conducted with MRSA personnel revealed the answer to the last investigative question. Mr. Jay Graver, LOGPARS Program Manager, shared his knowledge about LOGPARS and expert systems while Mr. Carlos Camacho demonstrated the maintenance system used to make changes to the program. The Strategy Advisor was modified using the process identified by the two gentlemen and described in Chapter V. ALD's acceptance of the prototype Air Force Strategy Advisor, the culmination of this research, showed that the LOGPARS program could successfully be adapted for the Air Force using the resources identified in Chapter V. As of the time of this writing ALD does not have the computer software needed to

modify LOGPARS and must use the technical expertise and computer resources of MRSA.

The Air Force must acquire the following capabilities to develop and maintain its version of LOGPARS:

(1) computer resources:

a. hardware: 286 or 386 PC with at least 80 megabytes of memory and 2 megabytes of RAM (current Zenith 248 PC's are OK),

b. software: LOGPARS Maintenance Program, text editor (recommend QEDIT), PROLOGUE compiler (recommend ARITY), a utility program capable of search/replace/find routines (such as Norton Utilities), and a utility capable of identifying relationships between data elements and files (recommend DAG).

(2) personnel resources:

a. technical expertise: personnel with knowledge of PROLOGUE and training on MRSA's maintenance system,

b. support: general computer services support.

The opinion of the researcher is that an Air Force version of the LOGPARS program would adequately support CALS objectives by integrating several important acquisition logistics tasks. As development of the program progresses more tasks could be added providing ILSMs with an even greater management tool.

The investment required to develop and maintain an Air Force LOGPARS program would pay substantial dividends to ALD by greatly improving the ability of ILSMs to provide the effective acquisition logistics support necessary to field reliable, maintainable, and supportable weapon systems. The opinion of the researcher is that the Air Force provide immediate funding and program support for ALD/LSL to complete the LOGPARS modification, including the required computer resources and technical expertise to develop, maintain, and improve the program. The emphasis should be not to develop LOGPARS independently of MRSA, but rather to "piggyback" on MRSA's releases and adapt the Army-based programs to Air Force needs.

#### Recommendations

The success of this research demonstrates that ALD/LSL should complete the modification of the LOGPARS program using the prototype Strategy Advisor as a foundation. The effort should be completed as soon as time and resources allow.

Develop LOGPARS. The researcher recommends not only that ALD/LSL proceed with the modification as soon as possible, but also that the Air Force immediately invest in the resources required to maintain the program with MRSA's assistance. However, the complicated knowledge base and

decision rules contained in the ILSP and SOW generators will require more research to correctly identify Air Force requirements. The researcher recommends further study to identify these requirements and update the Strategy Advisor as new data elements and files are added or changed due to changes in the other modules.

Establish Cross-Talk. The researcher recommends that a cross-talk be established by the Department of Defense involving all the uniformed service's agencies that provide ILSOs computer support for acquisition organizations. The purpose of the cross-talk would be to share acquisition lessons learned, identify and share existing computer tools, and cooperatively develop new tools. The purpose of this effort would be to avoid duplication of effort and share "good ideas." The best structure for this effort should be investigated to identify specifically how to bring the services together in a productive manner.

Software Tools Education. The final recommendation involves identifying specific software tools available to ILSMs to meet their needs until a fully integrated and completed Air Force version of LOGPARS can be developed. ALD/LSL knows the tools that are developed but more research is needed to identify how best to disseminate that knowledge to the ILSMs.

### Summary

This chapter provides the reader with a summary of the research effort and discusses the conclusions and recommendations of the researcher. The successful adaptation of the Strategy Advisor module of LOGPARS demonstrates that ALD/LSL should continue with the modification of LOGPARS. Additionally, the military services may benefit further by exploring ways of sharing knowledge of existing programs and development of new tools.

## Appendix A: ILSM Interviews

The purpose of the ILSM interviews was to provide the researcher with a personal understanding of how ILSMs view computer tools they use (or don't use) in their daily tasks, and determine if they believe that LOGPARS would be useful. The interviews were informal polls and discussions and the researcher did not intend to build a statistically valid study. However, this fact should not discredit the value of the information gained from the interviews. The information was obtained by asking several questions as follows.

1) Would you say that you are currently pleased or displeased with the computer tools you now have available for ILS planning?

The following refers to this question: Which of the following areas do you believe you would benefit from having a computer program?

- 2) generic acquisition strategy advisement
- 3) scheduling
- 4) preparation of ILSP
- 5) preparation of SOW
- 6) preparation of CDRL
- 7) warranty advisement
- 8) other

The responses to these questions follow:

<u>Question</u>	<u>Yes</u>	<u>No</u>	<u>No response</u>
1	1	8	0
2	7	1	1
3	9	0	0
4	8	0	1
5	7	0	2
6	5	2	2
7	8	0	1

Question number 8 was open ended and responses included: technical orders management, tracking SERDS and



support equipment requirements, spare parts computations, life cycle costing.

Interviewees expressed some overriding concerns of automation efforts and computer programs as they apply to ILS planning. They included the desire that all computer software programs be standardized, so all programs could "speak the same language" and personnel transitioning to a different system program office would not have to learn new computer programs. Another concern addressed the usability of software--if the program is simple to learn and relatively "user friendly" it tends to be accepted and used, while programs that are difficult to learn, too complex, or not "user friendly" tend not to be used. Finally, computer programs for ILS planning must be flexible to allow for tailoring to the specific needs of the system program office, and should serve as a baseline only.

The significance of the research findings supports the underlying assumptions of the CALS Initiative and indicates that progress has been slow in achieving the CALS objectives.

## Appendix B: Scheduling Initiative Survey Results Summary

The following is a summary of the results discovered by the Scheduling Initiative Survey conducted in 1989. The scheduling initiative surveyed SPO's to gather information concerning several issues. The issues relating to this thesis were scheduling support for PM's (because the ILSO should "tie in" to the PM's master schedule) and the network analysis tools used by SPO's (same reason). The respondents to the survey included functional managers (including DPML's/ILSM's), Programs & Integration Chiefs and Program Analysts. Out of a total of 116 respondents only 45 offered an answer to the question "What type of software does your organization use for scheduling." The most popular programs:

<u>Program</u>	<u>Number</u>
CSNAS	18
Timeline	6
Super Project	3
PMS	3
Quicknet	2
MacSchedule	2

Respondents occasionally offered two or three answers, indicating some offices may use more than one program, perhaps on different weapon system programs within the SPO.

Program managers indicated two surprising facts. First, only 9 out of 38 (23.7%) responding to the question "Is your scheduling support adequate?" answered "yes." Second, only 40% said they actually use networks.

The reader is directed to Donna Black, ASD/AC, for more information on the Scheduling Initiative Survey, dated 21 SEP 89. All references in this appendix are from the Scheduling Initiative Survey Results, same date.

The significance of the results, related to this study, is that integrated scheduling does not appear to be a reality at the SPO's at Wright-Patterson AFB. This fact is consistent with the CALS objectives.

## Appendix C: LOGPARS Strategy Advisor Change List

The following summary description identifies actual changes incorporated into the Strategy Advisor.

### Screen                    Description of Change

#### Title screen

Add statement to title screen identifying program as a prototype Air Force version 1.0 and list ALD/LSL as point of contact

#### Identify/Update Program Strategy - help

Last para. change "AR 70-1, System Acquisition Policy and Procedures" to "AFR 800-2 Acquisition Program Management"

#### NDI Category - help

Last paragraph, change "AR 70-10 Test & Evaluation During Development and Acquisition of Materiel" to "AFR 80-14 Test & Evaluation"

#### Levels of Testing - help

Para. 2 line 1, change "Early User Test & Experimentation (EUT & E), Force Development Test and Experimentation (FDT & E)" to "Initial Operational Test and Evaluation (IOT & E)"

Para. 3, last line, change "AR 70-10 ..." to "AFR 80-14 Test & Evaluation"

#### Identify Theatres

"FORSCOM" - delete  
"TRADOC" - change to "ATC"  
"WESTCOM" - change to "PACAF"  
"ARNG" - change to "AFNG"  
"USAR" - change to "USAFR"  
"USAISC" - change to "ESC"

#### Theaters - help

Para. 1 line 4, change "(such as the O & O Plan or ROC)" to "requirements documents (such as the SON or the SOC)"

Para. 2 line 2, change "MACOMS (to include Army...)" to "MAJCOMS (to include National Guard and Reserve units)"

#### Maintenance Concept

Delete question-no choice for maintenance concept

#### Maintenance Concept - help

Delete help text for this question

#### Levels of Maintenance

Change "unit" to "organizational"

Delete "Direct Support" and "General Support" and replace with "Intermediate"

#### Levels of Maintenance - help

Last line, change "AR 750-1 Army Material ..." to "AFR 66-1 Air Force Maintenance Policy"

#### ILS Elements Recommendations Report:

##### A. Design Influence

Change title to "A. Design Interface"

Para. 2, change "O & O Plan and the ROC" to "requirements documents"

#### Facilities

Para. 3, change "Corps of Engineers" to "Civil Engineering" and also same change as above

#### Support Equipment and TMD & E

Para. 6, change "Army" to "Air Force"

## Training

Line 3, change "MANPRINT" to "MPT Analysis such as HARDMAN (hardware-manpower tradeoff analysis)"

## Manpower & Personnel

Line 6, change "A MANPRINT Program must" to "MPT Analyses should"

Last para. ("In all, the integration of...", delete "MANPRINT")

ADD SENTENCE at end of last paragraph: "Consult AFLCP/AFSCP 800-34, Acquisition Logistics Management and AFR 800-8, Integrated Logistics Support (ILS) Program for more information"

## B. Maintenance Planning

### 1. Depot Maintenance Support Plan

Change title to read "Maintenance Activation Plan"

Para 1, delete and replace with "The Maintenance Activation Plan (MAP) is a plan showing the required events, resources, funding, and schedule necessary to achieve a maintenance capability for each reparable item at each site. The MAP may be a depot maintenance activation plan (DMAP) or the maintenance portion of a site activation plan."

Para. 2, change "DMSP" to "DMAP"

Para. 3, change "DMSP" to "DMAP" and ADD SENTENCE at end of paragraph "Consult AFLC/AFSCR 800-32, Depot Maintenance Activation Planning"

### 2. DMWR

Change title to "Activation Task Force"

Delete para. 1 and replace with "The activation task force is a working group of representatives from those agencies having a vested interest and involvement in activating an operational site or depot. The task force may be an operational site activation task force (SATAF) or a depot maintenance activation working group (DMAWG). The purpose of the task force is to review program

documentation to ensure the feasibility of goals and adherence to direction, develop and update MAPs, track progress of other planning elements and determine the impact on maintenance activation planning and document lessons learned."

Para. 2, delete entire para. ("The DMWR is not required...")

#### C. Supply Support

##### 2. Repair Parts and Special Tools List

Para. 2, change "MAC" to "MAP"

ADD PARAGRAPH: "3. Supply Support Guidance  
Supply support planning begins as soon as an end item is conceived, in accordance with DODD 4140.40, Provisioning of End Item Material. To be fully effective, provisioning must be a cooperative series of scheduled events between the contractor and the Air Force. Reference AFLCP/AFSCP 800-34, Acquisition Logistics Management and AFR 800-36, Provisioning of Spares and Repair Parts for more information."

#### D. Support Equipment and TMDE

ADD PARAGRAPH: "1. SE Master Plan (SEMP)  
The SEMP is a management tool to assist in acquiring, managing, and replacing SE. It should be coordinated with, and fits into, the overall planning framework provided by the Weapon System Master Plan. The purpose of the SEMP is to reduce and control proliferation by increasing visibility of common and developing SE. For more information on SE management consult AFR 800-12, Acquisition of Support Equipment."

Para. 2, change "MATDEV" to "Air Force"

Para. 3, change "CBTDEV" to "contractor"

Next to last para., change "CBTDEV" to "contractor"

#### E. Manpower, Personnel & Training

DELETE PARA. 1 AND REPLACE: "1. Manpower Planning

Throughout the early phases of system acquisition the contractor should be required to perform manpower, personnel, and training (MPT) analyses. Assistance is available to military logistics planners through the product division Deputy for Acquisition Logistics office to determine the appropriate manpower analyses and specific tools and techniques which would be most appropriate."

DELETE PARA. 2 AND REPLACE: "MPT is concerned with the link between equipment complexity and manpower and how equipment design issues translate into manpower requirements. MPT should influence equipment design to include manpower considerations as well as managing MPT planning.

Para. 2 (former para 2), change "Training Plan of Instruction" to "Training Development Plan (TDP)"

### 3. Training Reviews

Change all "POI" to "TDP"

### 5. New Equipment Training

Line 5, change "Army" to "Air Force"

### F. Technical Data

#### 1. Equipment Publications

Change title to "1. Technical Orders"

Para. 1, change "Equipment Publications" to "Technical manual (TM's) and Technical Orders (TO's)"

Para. 1 line 5, change "Army" to "Air Force"

Same para. last line, delete "...during TT/UT and..."

Para. 2, change "DA EP's" to "USAF TO's"

Same Para. line 2, change "FUED" to "IOC"

Same Para. line 3, change "EP's" to "TO's"

Next para., insert: The TOMA must complete the TODMP (see AFLCP/AFSCP 800-34) during the DEM/VAL

Phase and provide input for the RFP during the FSD and Production phases.

G. Computer Resources Support

1. Computer Resources Management Plan

Change title to "Computer Resources Life Cycle Management Plan"

Para. 1, same change

H. Transportation

Para. 1 line 3 change "O & O Plan" to "System Operational Capability (SOC)"

I. Facilities

Para. 2, change "The Corps of Engineers" to "Civil Engineering"

J. Support Management and Analysis

Para. 1 line 1, after "The Test and Evaluation Master Plan" ADD "TEMP"

K. Standardization and Interoperability

Para. 1 line 11, change "MATDEV" to "Air Force"

Same para. and line, delete sentence after "MATDEV"



## Appendix D: List of Equivalents

### LOGPARS TERMS

### Air Force Terms

#### Regulations:

AR 70-1	AFR 800-2
AR 70-10	AFR 80-14
AR 750-1	AFR 66-1

#### Theatres of operations:

FORSCOM	none
WESTCOM	PACAF
TRADOC	ATC
USAR	USAFR
ARNG	AFNG
USAISC	ESC

#### Maintenance levels:

unit	organizational
direct support	intermediate
general support	intermediate

Army (DA)	Air Force (USAF)
Combat Developer (CBTDEV)	contractor
Corps of Engineers	Civil Engineering
CRMP	CRLCMP
DMSP	DMAP
Equipment Pubs	Tech orders (also tech manuals)
FUED	IOC
MACOMS	MAJCOMS
MANPRINT	MPT analyses
Materiel Developer (MATDEV)	Air Force (or government)
MRSA	ALD

O & O Plans

requirements documents (SOC,  
SON)

ROC

SON

## Appendix E: Prototype Screen Examples

This appendix contains examples of the changes made to the Strategy Advisor. Examples include menus, helps, and prototype Strategy Advisor recommendations.

Identify the theaters to which the item will be fielded (at least one).

PgUp/PgDn
EUROPE
ATC
KOREA
PACAF
AFNG
USAFR

Up/Down	PgUp/PgDn scroll	<F1>/<Esc> Explain/Exit	
	<space> Select	/<F10> Continue	

Identify the theaters to which the item will be fielded (at least one).

PgUp/PgDn
PACAF
AFNG
USAFR
ESC
SOUTHCOM
OTHER

Up/Down	PgUp/PgDn scroll	<F1>/<Esc> Explain/Exit	
	<space> Select	/<F10> Continue	

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Select the levels of maintenance at which the end item will be repaired. In general it is best to select all maintenance levels. Not selecting a particular maintenance level should only occur if that level of maintenance can be completely ruled out as a result of a comprehensive Level of Repair Analysis. If the program dictates that a certain maintenance level will not be used, then this level should still be considered when performing the LORA. Parts/components which are recommended for repair at a non-candidate level will be a target for redesign.

For further information consult AFR 66-1, Air Force Maintenance Policy.

Select the candidate levels of maintenance for the end item.

<ul style="list-style-type: none"><li>✓ Organizational</li><li>✓ Intermediate</li><li>✓ Depot</li></ul>
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Up/Down	PgUp/PgDn scroll	<F1> / <Esc> Explain/Exit	
	<space> Select	"/ <F10> Continue	

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A. Design Interface

Design Interface is no longer a primary consideration for your program. The design should be fixed at this point in time. It may not be too late, however, to ensure that standard parts, tools, test equipment, facilities and transport vehicles continue to be a requirement of the design. It may also be possible to continue to reduce the number of reparable parts. Tradeoffs should be analyzed when design changes are made to determine the impact on supportability. Capitalize on any design changes which simplify operation and maintenance tasks. Your primary objective in the Full Scale Development phase should be to ensure that support resources are fully identified and plans for their availability at fielding are in place. Evaluations which measure the adequacy of transport vehicles, facilities, support and test equipment, repair parts, tools and other support resources are critical during this phase.

---

G. Computer Resources Support

## 1. Computer Resources Life Cycle Management Plan (CRLCMP).

Computer Resources Support includes the facilities, hardware, software, documentation, manpower, and personnel needed to operate and support computer systems. Computer resources include both standalone and embedded systems. A CRLCMP is required of all end items which utilize computer resources.

A CRLCMP is not required for the Demonstration/Validation phase.

## 2. Test Program Sets

See section D. Support Equipment and Test Measurements and Diagnostic Equipment for the results of the Strategy Advisor

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Full Scale Development Phase - Adequate T&E of production-representative items shall confirm that all significant design problems have been identified along with their solutions and items/components tested are effective/suitable for their intended purpose. Testing will include technical testing required to verify the production process and evaluate adequacy of component changes to the system.

Technical testing is a generic term which encompasses engineering-type testing conducted in laboratory, factory or proving ground environments and accomplished by engineers, technicians or soldier operator-maintainer test personnel. Technical testing includes technical feasibility tests, engineering development tests, production prove out tests, production qualification tests, first-article tests, quality conformance inspections and logistic demonstrations.

User testing is a generic term which encompasses testing in realistic operational environments with user representative troops. User testing includes Initial Operational Test and Evaluation (IOT&E), concept evaluation programs and Operational Test and Evaluation (OT&E).

For further information consult AFR 80-14, Test and Evaluation.

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The fielding theaters selected here will be used to construct a tailored acquisition milestone schedule for the theater-oriented milestones. To determine which fielding theaters apply to your system refer to the requirements documents (such as the SON or the SOC), the acquisition strategy or the USAF distribution guidance.

The contractor must coordinate closely with all gaining MAJCOMs (to include the Air Force Reserves, National Guard and other military services or Defense agencies) in planning for successful weapon system fielding.

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Select the levels of maintenance at which the end item will be repaired. In general it is best to select all maintenance levels. Not selecting a particular maintenance level should only occur if that level of maintenance can be completely ruled out as a result of a comprehensive Level of Repair Analysis. If the program dictates that a certain maintenance level will not be used, then this level should still be considered when performing the LORA. Parts/components which are recommended for repair at a non-candidate level will be a target for redesign.

For further information consult AFR 66-1, Air Force Maintenance Policy.

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Results for test -- Strategy Advisor: B.

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B. Maintenance Planning

1. Maintenance Activation Plan (MAP)

The Maintenance Activation Plan (MAP) is a plan showing the required events, resources, funding, and schedule necessary to achieve a maintenance capability for each reparable item at each site. The MAP may be a Depot Maintenance Activation Plan (DMAP) or the maintenance portion of a site activation plan. A DMAP is not required for your program since depot level maintenance will not be performed.

## Appendix F: Data Elements and Change Notes

Data Elements. The following data elements require tracing through other modules to ensure consistency when interfacing the Strategy Advisor with other LOGPARS modules:

1) main\_con - data elements for maintenance concept was deleted.

2) fielding\_theatres - data elements relating to this element were changed: FORSCOM (deleted), WESTCOM (change to PACAF), TRADOC (change to ATC), USAISC (change to ESC), USANG (changed to AFNG), USAR (changed to USAFR).

Other Data Items. These items are related to changed data elements:

1) DMSP - change all references to DMAP.

2) ADD data element to accept MAP to include this requirement in other modules.

3) TPOI - change to TDP



## Appendix G: Research Objectives Letter

ALD/LSL (Mr. Roe, 5-6587)

LOGPARS Research Objectives

AFIT/LSG (Capt Smeal)

1 JUL 90

1. Thank you for your interest in researching the LOGPARS adaptation. We firmly believe that the acquisition logistics function within the Air Force will greatly benefit from having an integrated logistics planning tool, such as an Air Force version of LOGPARS.

2. We expect your research to play an important role in our efforts to develop an Air Force version of LOGPARS. Our original objectives (March 1990) for your research were as follows:

a. Identify specific changes to the strategy advisor necessary for Air Force use, including text files, help files, and data files;

b. Make those changes to the strategy advisor and develop an Air Force prototype usable by acquisition logistics organizations.

3. Because your research discovered that changing LOGPARS was more complicated than we originally believed, we had to modify our objectives as follows:

a. Develop the working relationship between MRSA and ALD to "open doors" for continued cooperation and support, which we will need to succeed in this project;

b. Identify the resources, capabilities, and processes we will need to change LOGPARS for Air Force use;

c. Identify the specific changes necessary to adapt the Strategy Advisor for Air Force use;

d. Develop a prototype Strategy Advisor which can be used as a foundation for modifying the entire program.

4. When your research is complete we would like a copy of the thesis and the prototype Strategy Advisor. We hope you will continue to use the knowledge you have gained from the study to help complete the LOGPARS modification.

5. We will follow up with a research critique, per your request, to evaluate/critique the usefulness of your effort to our broader LOGPARS modification project.

  
James W. Roe  
CSNAS Technical Manager

## Appendix H: Research Critique Letter

ALD/LSL (Mr. Roe, 5-6587)

LOGPARS Research Critique

AFIT/LSG (Capt Smeal)

24 AUG 90

1. Thank you for your research effort on the LOGPARS adaptation. We are currently researching the requirements for modifying the ILSP Generator and have an agreement with the Army for them to develop a Schedule Advisor interface with CSNAS. Your work on the Strategy Advisor was vital in the overall effort in developing a cooperative working relationship with MRSA and identifying the capabilities and processes necessary for the LOGPARS modification.

2. The following summarizes our evaluation concerning how well your research effort met our objectives for the project:

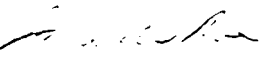
a. The working relationship between MRSA and our organization has greatly improved as a result of your efforts. Your visit to the Lexington Blue Grass Army Depot proved to be vital in securing MRSA's support to provide us with the capability to change and maintain our own inputs to LOGPARS from Wright-Patterson AFB. The alternative would be to fund MRSA and/or a contractor to make even simple changes for us. The importance of this achievement cannot be understated.

b. Your research identified the resources and processes we need to change and maintain LOGPARS. Again, your visit to MRSA at Lexington proved quite valuable because we had not developed the capability to make changes to LOGPARS at ALD and did not know the processes MRSA developed. The information you learned by changing the program revealed important facts about the maintenance and change processes. This information was new and valuable knowledge to us that we will employ in our modification efforts.

c. We reviewed your Strategy Advisor and believe it serves our purposes for a prototype. You identified and made changes while minimizing the effects on the structure of the knowledge base. This minimized interference with other modules that remain to be developed. Although we identified some minor changes for the next revision, the prototype is acceptable as is.

d. Our final conclusion is that your research contributed to our LOGPARS modification project and provided us with important benefits. The relationship and cooperation you fostered between MRSA and ALD improves our ability to complete the LOGPARS modification. The prototype you developed is useful. Perhaps the most vital and enduring aspect of your research is the knowledge gained regarding the resources, capabilities, and processes required to successfully change LOGPARS. We believe that all four of our research objectives were met in a satisfactory manner.

3. Thank you for your interest and valuable work. We look forward to working with you in the future on other modules to help ALD/LSL complete the LOGPARS modification.



James W. Roe  
CSNAS Technical Manager

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Vita

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